WHAT IS CLAIMED IS:

Sub A1

1. A surface acoustic wave device comprising a piezoelectric substrate; a first interdigital transducer and a second interdigital transducer formed on the substrate so that the first and second interdigital transducers are opposed to each other,

wherein the substrate includes a doping region that is doped with a substance in at least one form selected from the group consisting of atoms, molecules and clusters in a surface between the first and second interdigital transducers.

Sub B1 cont

2. The surface acoustic wave device according to claim 1, wherein a depth of the doping region is not more than 50nm.

3. The surface acoustic wave device according to claim 1, wherein the doping region has a lower resistance than that of an inner portion of the substrate.

Sub A2

4. The surface acoustic wave device according to claim 3, wherein a sheet resistance of the doping region is in a range from $10^8\Omega/\square$ to $10^{15}\Omega/\square$.

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5. The surface acoustic wave device according to claim 1, wherein the substance is a substance obtained by ionizing at least one selected from the group consisting of a reducing gas, silane, nitrogen, oxygen, argon, silicon, arsenic, boron, phosphorus, tin, indium, chromium, tantalum, molybdenum, germanium, and nickel.

6. The surface acoustic wave device according to claim 1, wherein the first and second interdigital transducers are provided with an insulating layer on surfaces thereof.

7. The surface acoustic wave device according to claim 6, wherein an average thickness of the insulating layer is in a range from 2nm to 500nm, and a resistivity of the insulating layer is not less than 10^6 Ω cm.

8. The surface acoustic wave device according to claim 6, wherein the insulating layer is made of a metal nitride or a metal oxide.

9. A method for producing a surface acoustic wave device comprising:

(a) forming a first interdigital transducer and a second interdigital transducer on a piezoelectric substrate so that the first and second interdigital transducers are opposed to each other; and

(b) forming a doping region in a surface between the first and second interdigital transducers by doping the surface of the substrate with a substance in at least one form selected from the group consisting of atoms, molecules and clusters before or after the process (a).

10. The method for producing a surface acoustic wave device according to claim 9, wherein the substrate is doped with the substance in a depth of not more than 50nm from the surface of the substrate.

11. The method for producing a surface acoustic wave device according to claim 9, wherein the doping region has a lower resistance than that of an inner portion of the substrate.

12. The method for producing a surface acoustic wave device according to claim 11, wherein a sheet resistance of the doping region is in a range from $10^{8}\Omega/\square$ to $10^{15}\Omega/\square$.

13. The method for producing a surface acoustic wave device according to claim 9, wherein the substrate is doped with the substance in ionized form.

14. The method for producing a surface acoustic wave device according to claim 13, wherein a dose of the substance is in a range from 1×10^{13} ions/cm^2 to 1×10^{17} ions/cm^2.

15. The method for producing a surface acoustic wave device according to claim 13, wherein the substrate is doped with the substance at an energy of 0.01keV to 10keV.

16. The method for producing a surface acoustic wave device according to claim 13, wherein the substance is a substance obtained by ionizing at least one selected from the group consisting of a reducing gas, silane, nitrogen, oxygen, argon, silicon, arsenic, boron, phosphorus, tin, indium, chromium, tantalum, molybdenum, germanium, and nickel.

17. The method for producing a surface acoustic wave device according to claim 9, wherein the substrate is doped with the substance by at least one technique selected from the group consisting of ion implantation, ion doping, plasma doping, laser doping and vapor phase doping.

18. The method for producing a surface acoustic wave device according to claim 9, further comprising (c) forming an insulating layer in surfaces of the first and second interdigital transducers by doping the surfaces of the first and second interdigital transducers with impurities after the process (a).

19. The method for producing a surface acoustic wave device according to claim 18, wherein the impurities are the same substance as said substance, and the process (c) is performed at the same time as the process (b).

20. The method for producing a surface acoustic wave device according to claim 18, wherein the impurities are oxygen or nitrogen.

21. The method for producing a surface acoustic wave device according to claim 18, wherein an average thickness of the insulating layer is in a range from 2nm to 500nm, and a resistivity of the insulating layer is not less than $10^6\ \Omega$ cm.

22. A surface acoustic wave device comprising a piezoelectric substrate, a first interdigital transducer and a second interdigital transducer formed on the substrate so that the first and second interdigital transducers are opposed to each other,

wherein the substrate includes a plurality of conductive regions spaced apart from each other on a surface thereof between the first and second interdigital transducers, and a tunnel current flows between the first and second interdigital transducers via the conductive regions.

add B2